AGRICULTURE IN OUR HIGH SCHOOLS.

A thesis submitted to the
faculty of the Graduate School
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by
D. Edward Hickey
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"Industrial training, training which will fit a girl to do work in the home, which will fit a boy to work in the shop if in a city, to work on a farm if in the country, is the most important of all training aside from that which develops character, and it is a grave reproach to us as a nation that we have permitted our training to lead the children away from the farm instead of toward it."

Ex-President Roosevelt.

The teaching of agriculture in our High Schools is so recent and changing that anyone who attempts to write a thesis on the subject chosen for my thesis will have to modify and add to anything written from time to time. When I mention agriculture, I mean "Agriculture," not nature study nor any twist of the regular science subjects established in our High School curricula.

I believe the subject of agriculture should be taught in our elementary schools, high schools and colleges, especially where the constituencies are largely rural. More than one-half of our population

live in the rural communities. Why should they be deprived of the opportunities to increase their welfare and thus bring happiness to their homes? But while agriculture should be taught in elementary schools in a limited way, the proper place for the teaching of agriculture is in the secondary schools of our country. There the pupils are older than in the elementary schools, and are thinking of vocations; the teachers are better prepared, and the equipment is more elaborate.

Our High School courses must be modified, not discarded, so as to include a course in agriculture and open up to our thousands of country as well as thousands of city boys and girls a vision of their possibilities. Too many of our High School authorities have the erroneous idea that the study of agriculture is not of any educational, intellectual, pedagogical or practical value. Agriculture presents facts and truths that are worth while knowing by every intelligent man. It develops principles that illustrate natural laws in many fields. It organizes processes. It gives manual work. It trains one in all

the humbler virtues of life, gives scope to his artistic impulses and offers ample opportunity for co-operation as well as for emulation. It trains the powers of observation as almost no other subject does. Fortunately, people are becoming more and more less narrow minded in their views and are looking upon the subject of education from the child's view point, and are asking themselves what can we do for the child. Again, too many schools do not put agriculture into their courses because the "University" does not accept it as a credit towards entrance. The day is fast going by when agriculture will not be accepted towards university entrance.

There is throughout our country a favorable sentiment to have agricultural departments connected with the established High Schools rather than have special agricultural schools. I believe secondary education in agriculture will do more good for the country if taught in our present high schools for these reasons:-

(a) Our High Schools are a part of our general systems of Schools.

(b) The special school is more narrow and exclu-

sive in its purpose.

(c) Agriculture will vitalize the non-vocational subjects of our High School.

(d) High School pupils may live at home. This will tend to bring the home and school in closer union. High School pupils are better off at home.

(e) The curriculum of a regular High School is broader in its scope, and the true relation between the vocational and non-vocational is maintained.

(f) Pupils will be more likely to find themselves and will have a better appreciation for other callings.

(g) It is cheaper to carry on agricultural instruction in our High Schools than in special schools, consequently more effective work can be done.

The advocates of the special secondary agricultural school maintain that it emphasizes vocation, it will have more special equipment and that it will have an agricultural atmosphere.

What our States are doing in Secondary Agriculture.

Alabama.-Agriculture is required by law to be regularly taught in all schools with the use of a text book, and is required for teachers' certificates. There are nine congressional high schools and five county schools. All of these receive state aid.

Arkansas, Georgia.-Similar to Alabama.

Indiana.-A regular course of study of agriculture has been adopted in a few of the counties.

Kentucky.-Authorized in county high schools.

Idaho.-Authorized in rural high schools.

Maine.-Agriculture in relation to the high school sciences required in all free high schools.

Massachusetts.-Cities and towns may establish independent agricultural schools and may receive state aid.

Michigan.-Specifically authorized in rural high schools.

Mississippi.-County agricultural high schools authorized. State aid is given.

Nebraska.-Required in county high schools.

New York.-Cities and towns may establish agricultural high schools. May receive state aid.

Oklahoma.-State schools of agriculture are established.

Ohio.-Agricultural instruction in all but city schools.

Pennsylvania.-Nothing definite. High school expert began work on agricultural education March 1, 1913.

Virginia.-Has ten congressional agricultural high schools; state aid.

Wisconsin.-Any Board having charge of a high school may establish and maintain a department of manual training, or domestic economy, or agriculture, or any or all of said departments. State aid of three hundred fifty dollars for each department is allowed. County agricultural schools are established.

Minnesota.-Thirty departments of agriculture have been established in the graded and the high schools under the Putnam act. Seventy-five similar departments are established under the Benson-Lee act of 1911. State aid is given to those schools, the Putnam act schools receiving $2500 each and the Benson-Lee act schools $1000 each per annum. There are three schools of agriculture.

The following questionnaire was sent out by me to all the state superintendents of our country:-

(a) Number of four-year high schools teaching

any phase of agriculture?

(b) Number of four-year high schools in state? Some of the states failed to report; others <u>didn't have anything</u> to report. I will give the results as turned in by several of the states.

States	(a)	(b)	States	(a)	(b)
Connecticut	0	?	New York	17	700
Idaho	23	90	New Jersey	0	96
Illinois	28	396	New Mexico	3	15
Indiana	Few	360	North Dakota	30	50
Kansas	32	247	Ohio	50	353
Louisiana	25		Tennessee	10	?
Massachusetts	18	225	Texas	34	?
Minnesota	77	206	Utah	24	32
Michigan	15	?	Virginia	10	?
Montana	8	36	Wisconsin	12	303
Nebraska	100?	140			

The above statistics plainly show that agricultural education in our high schools is only in its infancy. The signs are good, and the time is not far distant when practically all the high schools will have a department of agriculture. The state depart-

ment of Public Instruction writes, "The University of Arizona is the only institution in the State that has a department of agriculture. A bill is before the present State Legislature to install this subject in all the public schools of the State." What a glorious example the young state of Arizona is setting for the older states!

From the State Department of Kentucky comes this statement in answer to my questionnaire: "At present, the teaching of agriculture is not required in the High Schools of this state. I will say, however, that we have a bill introduced in both branches of the Legislature which is now in session, providing for the teaching of this subject in the schools of the state, including the rural schools. We have reasonable hope of this bill becoming a law."

Similar expressions have come from other states, but the most encouraging sign of the success of High School agricultural education is the Page Bill now before Congress. It is a Bill "to co-operate with the States in encouraging instruction in agriculture, the trades and industries and home economics in Secondary Schools; in maintaining instruction in these

vocational subjects in State Normal schools; in maintaining extension departments in State Colleges of agriculture and mechanic arts; and to appropriate money and regulate its expenditure." Referring to the above Bill, the U. S. Bureau of Education writes in a letter to me: "There is great need for such legislation and the bill as reported from the Senate committee has the approval of the Commissioner of Education."

State Supt. C. G. Schulz of Minnesota says of the Bill: "I heartily approve the provisions of this measure. It is along the same lines as those in which Minnesota has undertaken to foster that work in connection with high schools, secondary agricultural schools and the college of agriculture. I am fully satisfied that the plan outlined in your bill for industrial training, not only in secondary schools but in colleges and normal schools, is practical, comprehensive, fair and demanded by present-day conditions."

The bill has been commented upon in favorable words by the leading educators, statesmen, business men and professional men from all over the country. Should the bill fail of passage this year, a new one undoubtedly will be acted upon in the near future.

Some Typical High Schools Having a Department of Agriculture with their Outlines of Work.

(The schools will be chosen to illustrate the different kinds of agricultural high schools, to represent the different sections of our country and to show the different courses of study).

Snohomish High School, Washington State.

An instructor in agriculture is hired for the whole year. They have a well equipped laboratory for all simple chemical and physical experiments in soils, fertilizers, etc. A dairy laboratory is equipped with four separators, all necessary utensils, churns, butter worker, etc. They have a complete gardening outfit, hand and power sprayer, and extensive equipment for pruning and grafting. A greenhouse and a tract of land for experimental purposes has been added to the equipment. There is a separate farm mechanics building 22 x 60, in which a large line of up-to-date machinery has been installed by implement manufacturers. Milk testing is done for the farmers. Orchards are also taken charge of. A good reference library of special books and governmental bulletins is a part of the institution.

The following is the general agricultural outline:-

First year.-Dairying and Animal Husbandry.

Second year.-Soils and Crops.

Third year.-Horticulture and Vegetable Gardening.

Fourth year.-Farm Management and Farm Mechanics.

Waterford, Pennsylvania.

Waterford was the first school in Pennsylvania to establish an agricultural course. This was established in 1904--1905. Some one agricultural study is taken during each of the four years of high school work. In addition to the agricultural studies, the students in that course are required to take other high school branches, including mathematics, natural sciences, literature, rhetoric, etc. Besides the regular laboratory and recitation work, students in the agricultural classes are required to prepare special papers on various live interesting agricultural topics. The work of the department is as practical as possible. Milk is tested; rations are compounded; grafting, pruning and propagating plants are some of the exercises given to the plant life class; soils are tested; weeds

are eradicated.

The course for the High School is:-

First year.-Plant Life.

Second year.-Cereals, Vegetables, Fruit.

Third year.-Animal Studies, Soils, Physics.

Fourth year.-Chemistry of Soils, Chemistry of Plants and Animal Life.

La Salle-Peru Township High School, Ill.

The course in agriculture which was introduced two years ago in connection with a fully equipped laboratory, lecture room and experimental lands was added to the school with the intention of making education practical and to prepare the young for the task of making a living. Large school gardens have been established near the school, and an experimental farm of fourteen acres was recently put in operation with the view of solving for the agricultural public at large such practical farm problems as may arise in that part of the state.

Schedule of studies by years in the High School:-

First year.-English, Algebra or Practical Mathe-

matics, Manual Training, Calisthenics; Agriculture--Farm Crops, Soil Physics.

Second year.-English, Plane Geometry, Manual Training, Forge and Iron Work, Cement and Concrete Construction, Farm Mechanics, Mechanical Drawing and Gas Engines; Agriculture--Horticulture, Gardening, Homestead Economics, Tiling, Drainage, etc.; Calisthenics.

Third year.-English, Botany and Zoology, Bookkeeping, Farm Accounts; Agriculture--Animal Studies and Soil Fertility.

Fourth year.-U. S. History and Civics, Chemistry, Commercial Geography and Economics; Improvement of Animals and Plants, Breeding, Crossing, Farm Architecture, etc.

Lyndon Institute, Vermont.
(Special and Private School).

This school serves as a typical special school of agriculture and will answer for an average county or congressional agricultural school. The object of its promoters was the giving of practical and theoretical instruction in agriculture to Vermont boys who have neither money nor inclination to pursue an

extensive college course. It is strictly a Farmers' School and it aims to educate students along the various lines of work that will be met with on the farm and in the home life. It is not intended to fit students for college but to furnish a line of training that will be of immediate use in farming and its allied industries,-like carpentry, blacksmithing, masonry and concrete work. There is a two-year course open to eighth grade graduates. The tuition may be paid in cash or by work on the farm at fifteen cents an hour, and twenty-five dollars per month during the summer vacation.

The course of study in brief:-

First year.-Elementary Agriculture, Breeds of Animals, Agricultural Chemistry, Principles of Plant culture, Blacksmithing, Carpentry, Soils and Manures, Farm Dairying, Fruit Growing, Farm Crops, Gardening, English Grammar, Arithmetic.

Second year.-Feeds and Feeding, Farm Forestry, Plant Diseases, Greenhouse Management, Poultry, Dairying, Animal Breeding, Blacksmithing, Carpentry, Farm Management, Farm Drawing, Farm Bookkeeping, Home Decoration, Physiology and

Hygiene, Civics.

Minnesota has twenty-seven four-year high schools with departments of agriculture. The work of any one will do as a type for all. There is the usual four-year course in agriculture following the general outline of:-

First year.-Farm Crops.

Second year.-Animal and Dairy Husbandry.

Third year.-Farm Mechanics.

Fourth year.-Soils, Horticulture.

Each school has a school farm varying in size from five acres to a rented farm of 160 acres. The farm is used for demonstrations and gardens. Extension work is done among the farmers. Institutes are held in the rural schools and Farmers' Short Courses are held.

Short Courses of about three months each are held for the purpose of giving the farm boys and girls an opportunity to take up some industrial work without the usual scholastic requirements for admission to regular courses.

Manual Training, Sewing and Cooking accompany the agricultural courses in all schools. Each school has one main object in view--to make all work

practical, of some value, and to get the farmer interested in the new work.

To my mind, Minnesota has the best system of agricultural high schools in the country. I have arrived at that conclusion only after studying the bulletins, courses of study and school laws of all the states in the Union. Other states have not gone into the work with as much spirit and definiteness of aim.

Michigan has prepared a general High School Course in agriculture, which is elective and includes one unit in each grade of the high school, giving a four-year course. Each unit is made up of a combination of two or more subjects, which are to be pursued during the year. It is the intention of the state to have the agricultural department in the high school run parallel to the departments of Manual Training or Domestic Science, and regular students may elect these subjects in addition to the required work of the high school course. The course provides for daily recitations two or three periods each week, the other days being used for laboratory work and for study and observation on the experimental plots or on farms. Short courses are urged to be established.

Course:-

First year-
1. Botany.
2. Agricultural Botany.

Second year-
1. Crops and Soil Elements.
2. Horticulture and Entomology.

Third year-
1. Live Stock and Dairying.
2. Soils and Soil Physics.

Fourth year-
1. Live Stock Improvement.
2. Feeds and Feeding.
3. Farm Management.
4. Farm Mechanics--Farm Architecture.

Wisconsin has also adopted a suggestive agricultural course of study for its high schools. It is the plan adopted by the Association of Colleges and Experiment Stations.

First year-
1. Farm Mechanics, Botany.
2. Science--Beginners' Chemistry where no other is taught.

Second year-
1. Plant Husbandry.
2. Science--Physical Geography and Physiology.

Third year-
1. Animal Husbandry.
2. Science--Chemistry, Agri. Chemistry.

Fourth year- (1. Soils, Farm Management.
(2. Science--Physics.

A City High School Agricultural Department.

A city is justified in having a course in agriculture--some phase of it. While a city may act unwisely by putting a course in farming in its high school curriculum, it certainly would act wisely by offering a course in horticulture, vegetable gardening, poultry, floriculture and the fundamentals of dairying. In the first place, these subjects will add interest to the already established courses and will give many students an opportunity to take up something that they like. In the second place, the cost of living now-a-days almost necessitates the average city family to work a garden and to keep a cow and chickens. Professional and business men of the city will tell you that to know the "knack" of raising vegetables, poultry, and of keeping a cow is a very good asset to one's business knowledge.

Many city schools throughout the country are taking up the subject of gardening. St. Paul and Minneapolis are especially famed in that direction.

South St. Paul has an agricultural department in connection with its high school. The department comes under the Benson-Lee Act, which authorizes high school agricultural departments in Minnesota under certain conditions. South St. Paul is a true city in that it has all the requirements of a large city and is strictly urban in its existence. An agricultural instructor is hired by the year to take charge of the work. He has a class of thirty-five high school students in agriculture, and besides he gives the upper grade students a lesson a week in gardening.

The course consists of: Agricultural Botany, Fruit Raising, Vegetable Gardening, Poultry, Landscape Gardening and Greenhouse Management. There is a well-equipped laboratory to carry on the work as it progresses. Next year it is planned to have poultry colonies and a greenhouse. In connection with the laboratory there is a demonstration plot of ground across from the high school building. The classes do not depend upon the school garden for all of the observations but go to the neighboring truck farms for practical work about once a week.

The Board of Education has appropriated mon-

ey for prizes to be awarded to successful student gardeners. About one hundred upper grade children have volunteered to meet the agriculturalist every Saturday throughout the spring and summer to get instruction in gardening. They will have home garden plots. These will be inspected by the agriculturalist from time to time. Extension lectures will be held in the various schools during the spring time. The subjects will be vegetable gardening, poultry and fruit. The lectures will be given by specialists connected with the college of agriculture and will be given in the evenings.

In conclusion, I might say that the success of agricultural high school departments is being rapidly secured and the many difficulties and problems met with in their infancy are being cleared up. Among these problems I may mention: the problem of the agricultural teacher; the problem of getting the farmers to co-operate with the school; the problem of university credit; the problem of the relation of agriculture to the other courses and subjects in our high schools; the text book problem; and the problem of adapting the course to the needs of the community, which is a vital matter.

APPENDICES

APPENDIX A

(1) Condensed Outline of each unit of Agricultural Work in a four years' high school course. It is used in Wisconsin as a suggestive outline and it is also recommended by the U. S. Department of Agriculture.

FARM MECHAMICS--One-half unit.

I. Mechanical Drawing:-
   1. Use of instruments.
   2. Ordinary conventions.
   3. Practice in lettering.
   4. Making and reading tracings and blue prints.

II. Buildings, Roads and Bridges:-
   1. Drawing plans of barns, silos, and other farm buildings.
   2. Making blue prints of same.
   3. Study of road construction.
   4. Study of culverts and plans for same.

FARM MANAGEMENT--One-half unit.

I. Bookkeeping:-

   1. General principles of accounts.
   2. Keeping of farm accounts.
   3. Practice in keeping necessary farm records.
   4. Attention to penmanship, spelling and general appearance.

II. Business Forms and Commercial Law:-
   1. Making of notes, receipts, bills, etc.
   2. Use of weigh bills, bills of sale, etc.
   3. Law of contracts.
   4. Other principles of Commercial Law as applied to farm transactions.

PLANT HUSBANDRY--One unit.

I. Plant Diseases:-
   1. Microscopical study of fungous plants.
   2. Molds, smuts, rusts, blights.
   3. Other diseases of plants.
   4. Bacterial diseases of animals.

II. Agronomy:-
   1. Corn judging and testing.
   2. Examining and grading grains.
   3. Study of weeds.
   4. Inspection of clovers and grass seeds.
   5. Study of legumes and forage plants.

III. Plant Propagation:-
   1. The use of propagating beds.
   2. Potting.
   3. Grafting and budding.
   4. Rooting cuttings.

IV. Gardening:-
   1. Seed testing.
   2. Hot beds and cold frames.
   3. Transplanting.
   4. Outdoor gardening.

ANIMAL HUSBANDRY--One unit.

I. Breeds of Live Stock:-
   1. Principles of breeding.
   2. History of progress made in animal breeding.
   3. Standard breeds.
   4. Breed characteristics.

II. Stock Judging:-
   1. The "points" on the score card.
   2. Lantern slide demonstrations.
   3. Practice in judging stock easily available.
   4. Visits to best herds in vicinity.

III. Poultry:-
1. Poultry as an economic factor in farm and city life.
2. The care and management of poultry.
3. Feeding poultry and marketing poultry products.
4. Judging poultry.

IV. Insects:-
1. Life histories of insects.
2. Collecting and preserving specimens.
3. Insects injurious to our fruits and grains.
4. Means of controlling ravages of insects.

AGRICULTURAL CHEMISTRY AND SOILS--One unit.

I. Dairying:-
1. Testing milk and its products for fat.
2. Testing for acidity.
3. Testing butter for moisture and salt.
4. Testing milk for impurities and adulterants.

II. Feeds and Feeding:-
1. Protein and fat and their functions.
2. Analyses of feeds.
3. Rations and feeding standards.

III. Soils and Fertilizers:-
1. Physical analysis of soils.
2. Chemical composition of soils.
3. Classification of soils.
4. Tillage and inoculation of soils.
5. Fertilizing elements of soils.
6. Natural fertilizers including legumes.
7. Commercial fertilizers.
8. Chemical constituents.

IV. Drainage:-
1. Physics of drainage.
2. Principles of drainage.
3. Methods employed.
4. Practice in mapping, ditching and laying tile.

(2) Syllabus of a four-year Secondary Course in Agriculture. Prepared by the U. S. Department of Agriculture.

Required Subjects.

Subjects	Units.	1st yr.	2d yr.	3d yr.	4th yr.	Total hours.
English	3	5	5	3	2	540
Algebra	1	5	------	-----	------	180
Geometry	1	------	5	-----	------	180
History	1	------	------	2	3	180
Botany	1	5	------	-----	------	180
Chemistry	1	------	5	-----	------	180
French or German	2	------	------	5	5	360
Agriculture	4	5	5	5	5	720
Elective	2	------	------	5	5	360
Total						2,880

Elective Subjects.

	Units	Hours per wk.	Total hours.
Drawing	1-5	1 hr. 1 yr.	36
Bookkeeping	1-5	1 hr. 1 yr.	36
Civics	2-5	2 hr. 1 yr.	72
Solid geometry	1-2	5 hr. ½ yr.	90
Plane trigonometry and surveying	4-5	2 hr. 2 yr.	144
French or German	1	5 hr. 1 yr.	180
Botany, chemistry, or physics	1	5 hr. 1 yr.	180
Agriculture, horticulture or elementary forestry	....	1 to 5 hours 3d and 4th years.	

Required Subjects for all Students in Agriculture.

Subjects	Units	1st yr.	2d yr.	3d yr.	4th yr.	Total hours
The Plant and its Environment	2-5	2	....	....	.....	72
Farm Crops	1-5	1	....	....	.....	36
Agricultural Engineering	2-5	1	....	1	.....	72
Horticulture and Forestry	1-5	1	....	....	.....	36
Economic Entomology	2-5	....	2	....	.....	72
Animal Husbandry	2-5	....	2	....	.....	72
Dairying	1-5	....	1	....	.....	36
Diseases of Plants and Animals	2-5	....	....	2	.....	72
Farm Management	2-5	....	....	....	2	72
Subjects to be added from the subjoined list A	1	....	....	2	3	180
Total						720

Subjects from which Selection must be made to Make Up the Required 720 Hours in Agriculture.

Subjects	Hours per wk. 3d yr.	4th yr.	Total Hours.
Farm Crops	2	2	72 or 144
Animal Husbandry	2	2	72 or 144
Dairying	2	2	72 or 144
Horticulture	2	.....	72
Forestry	2	.....	72
Agricultural Engineering	.....	2	72
Rural Economics	1	1	36 or 72
Plant Breeding	1	2	36 or 108

APPENDIX B

Necessary Laboratory supplies for class of twelve in Agriculture. Prepared by K. L. Hatch of the Wisconsin college of agriculture.

	Estimated Price.
I. Farm Mechanics and Management:-	
1. One dozen sets drawing instruments @ $1.50	$18.00
2. One dozen T squares @ $.40	4.80
3. One blue print frame, home made.	
4. One dozen drawing boards, home made.	
5. One dozen 45° triangles	1.00
6. One dozen 30°--60° triangles	1.00
Total	$24.80
II. Plant Husbandry:-	
1. One dozen dissecting microscopes @ $1.50	$18.00
2. One dozen seed corn testers to be made by students.	
3. Two dozen tin plates for seed testers @ $1.00	2.00
4. Propagating bed, 2' x 3', home made.	
5. Hot bed or glass house, home made.	
6. Cold frame, home made.	
7. Four dozen 3" pots @ .15	.60
8. Four dozen 6" pots @ .25	1.00
9. One dozen grafting knives @ .30	3.60
Total	$25.20
III. Animal Husbandry:-	
1. Lecture room so screened as to be easily and quickly darkened.	
2. Set of animal charts, home made.	
3. Supply of score cards for the various types of farm animals, local printer.	
4. One dozen stretching boards, home made.	
5. One dozen cyanide collecting bottles, home made.	

6. Three boxes insect pins--Nos. 1, 3, 6.	$0.40
7. Materials for spraying solutions.....	1.00
8. Hand spray pump.....	2.50
9. Charts and Riker mounts.	
Total.....	$3.90

IV. Agricultural Chemistry and Soils:-

1. One six-bottle Babcock hand tester...	$9.00
2. Supply of extra glassware including skim-milk and cream bottles.....	3.00
3. One dozen 100cc. graduated cylinders @ .50.....	6.00
4. Box Farrington's alkaline test tablets.....	1.50
5. One set Torsion balances accurate to .01 gram with weights.....	20.00
6. One dozen common lactometers @ .50...	3.60
7. One Benkendorf's moisture test for butter.....	5.00
8. One set soil sieves.....	6.00
9. Two bottles sensitive litmus paper, red and blue.....	.40
10. Samples of various commercial fertilizers.	
11. Samples of various commercial feeds..	
Total.....	$54.00

The above lists comprise the minimum equipment possible for effective instruction in the several units of agriculture subjects. To this should be added at earliest possible convenience the items included in the following lists:

II. For Plant Husbandry Instruction:-

1. One compound microscope, triple objective 2/3, 1/6, 1/12, Abbe condenser, oil immersion.....	$75.00
2. One graduated hypodermic syringe.....	2.50
Amount forwarded.....	$77.50

Brought forward.....	$77.50
3. One-half dozen clinical thermometers @ .75.....	4.50
4. Four dozen 3" Petri dishes @ $1.80..	7.20
5. One dozen hoes @ .40.....	4.80
6. One dozen garden rakes @ .50.....	6.00
Total.....	$100.00

III. For Animal Husbandry Instruction:-

1. Good lantern with abundant supply of animal slides.....	$100.00
2. Incubator and brooder.....	20.00
3. Good barrel spray pump.....	20.00
4. Empire show cooping.....	10.00
Total.....	$150.00

IV. For Chemical Instruction:-

1. Additional 6 or 8 bottle Babcock hand tester.....	$9.00
2. One cream scale.....	6.00
3. One-half dozen Quevenne lactometers @ $1.60.....	9.60
Total.....	$24.60

APPENDIX C

Elementary Agriculture.

The following outline in elementary agriculture is intended for graded schools and rural schools. All grades from the second to sixth usually are given nature study in some form at least once a week. Grades from the fifth to the ninth may be given a course in "elementary agriculture." The outline that follows is used in the Michigan elementary schools, and is designed primarily for the sixth, seventh and eighth grades. One hour a week may be set aside for the work.

OUTLINE

I. Agronomy.
   1. Crops.
      a. Structure of farm seeds and grains.
      b. Seed testing.
      c. Manner in which young plants appear from seed grain.
      d. Manner in which young plants appear above ground.
      e. Kinds, uses.
      f. Time of planting, period of growth, and means of harvesting.
   2. Soils.
      a. Kinds, structure, and composition.
      b. Study of moisture, temperature, and air of the soil.
      c. Common means of making soils productive.

II. Horticulture.
   1. Germination of seeds.
   2. Propagation of plants.

a. Seeds.
b. Layers.
c. Runners.
d. Budding.
e. Grafting.
Materials needed,-sharp knives, boxes of earth, raffia, wax.

3. Garden vegetables and plants.
a. Planting.
b. Culture.
c. Harvesting uses.
d. Common Sprays for fruit trees and plants.

4. Flowers.
a. Seeds.
b. Bulbs.
c. Slips or cutting.
Manner and form of planting.
Proper effects.
Window gardens.

III. Forestry .
1. Common trees and shrubs of the locality.

IV. Botany.
1. Common weeds--a few from the locality.
2. Structure, flowers, seeds, distribution, destruction.

V. Entomology--A few insects.
1. Recognition.
2. Harm done.
3. Means of destruction.

VI. Ornithology--Birds.
1. Recognition.
2. Song.
3. Habits.
4. Nests.
5. Usefulness.

VII. Animal Husbandry--Animals, kind, uses, care.

VIII. Mechanics--Tools, care and use.

SOME ELEMENTARY TEXTS

"First Principles of Agriculture", Goff & Magne--American Book Co.

"Agriculture for Beginners", Burkett, Stevens & Hill--Ginn & Co.

"First Principles of Agriculture", Vourhees--Silver Burdette Co.

"First Book of Farming", Goodrich-- Doubleday, Page Co.

"Rural School Agriculture", Davis--Orange Judd Co.

"Elementary Agriculture", Hatch & Hazelwood--Rowe, Peterson Co.

"Introduction to Agriculture", Upharn--D. Appleton Co.

"Agriculture for Common Schools", Fisher & Cotton--Chas. Scribner Sons.

"Agriculture for Young Folks", Wilson--Webb Publishing Co.

APPENDIX D

Training of Teachers for Agricultural Work.

The following outline of work that a teacher of agriculture should pursue before taking up the teaching of agriculture is taken from the "Report to the 47th General Assembly of the State of Illinois".-(1911).

All teachers of agriculture should have a degree of scholarship and special preparation equivalent to a good four-year course of study in which science shall predominate, followed by at least two years of special training in agriculture.

Program in Agriculture.

1. Agriculture.-6 units (a unit means 12 weeks work).
2. Economic Botany.-1 unit.
3. Entomology.-1 unit.
4. Chemistry.-3 units.
5. Physiology and Hygiene.-1 unit.
6. Manual Training.-3 units.
7. Economics.-1 unit.
8. Rural Sociology.-1 unit.
9. Farm Arithmetic and Bookkeeping.-1 unit.
10. Principles and Method of Teaching.-3 units.
11. Practice teaching.- 2 units.

This program presupposes a high school course in Botany, Zoology, Physics, Chemistry and Physical Geography.

APPENDIX E

Text and Reference Books.

I. Farm Mechanics and Management:-
The number following the title refers to the publisher in the list of publishers.

Author	Title
*Roberts	Farmers' Business Handbook (1)
*Roberts	The Farmstead (1)
King	Ventilation (17)
Davidson & Chase	Farm Machinery and Farm Motors (3)
*Tracy	Introductory Course in Mechanical Drawing (4)
*Taylor	*Agricultural Economics (1)
*Anthony	Elements of Mechanical Drawing (8)
*Bennett	Problems in Mechanical Drawing (30)

II. Plant Husbandry:-

Coburn	The Book of Alfalfa (3)
*Hunt	Cereals in America (3)
Spillman	Farm Grasses in the United States (3)
Shaw	Soiling Crops and the Silo (3)
Wing	Alfalfa Farming in America (15)
*Hunt	Forage and Fibre Crops in America (3)
*Russell & Hastings	Agricultural Bacteriology (16)
*Conn	Bactria, Yeasts and Molds in the Home (2)
Bailey	The Forcing Book (1)
Waugh	The American Apple Orchard (3)
*Duggar	Fungous Disease of Plants (2)
*Lyon & Montgomery	Examining and Grading Grains (2)
*Bailey	Nursery Book (1)
*Bailey	Garden Making (1)
Myrick	Book of Corn (3)
Dondlinger	Book of Wheat (3)
Frazer	The Potato (3)
Bailey	Principles of Fruit Growing (1)
Bailey	Pruning Book (1)
Greene	Among School Gardens (24)

*Suitable for texts.

Author	Title
Card	Bush Fruits (1)
Rawson	Success in Market Gardening (12)
*Bailey	Principles of Vegetable Gardening (1)
Bennett	The Vegetable Garden (12)
Taft	Greenhouse Construction (3)
Bailey	Plant Breeding (1)
Bailey	Cyclopedia of Horticulture (1)
Bennett	The Flower Garden (12)
Maynard	Landscape Gardening (10)
Bailey	Manual of Gardening (1)
Lodeman	Spraying of Plants (1)
*Stevens & Hall	Diseases of Economic Plants (1)
Weed	Farm Friends and Farm Foes (8)
Lipman	Bacteria in Relation to Country Life (1)
*Goff	Principles of Plant Life (14)

III. Animal Husbandry:-

Smith	Our Insect Friends and Enemies (11)
Comstock	How to Keep Bees (12)
*Plumb	Types and Breeds of Farm Animals (2)
Punnett	Mendelism (1)
Davenport	Domesticated Animals and Plants (2)
Doncaster	Heredity (23)
Shaw	Animal Breeding (3)
Wing	Sheep Farming in America (15)
Roberts	The Horse (1)
Johnstone	The Horse Book (15)
Coburn	Swine in America (3)
Craig	Diseases of Swine (3)
Mayo	Diseases of Animals (1)
Reynolds	Veterinary Studies (1)
*Robinson	Poultry Craft (3)
Valentine	How to Keep Hens for Profit (1)
Salmon	Diseases of Poultry (3)
Mumford	Beef Production (29)
Bach	How to Judge a Horse (5)
Wilcox	Farm Animals (12)
Shaw	Management and Feeding of Cattle (3)
*Decker	Cheese Making (14)
*Brigham	Progressive Poultry Culture (28)
*Craig	Judging Live Stock (26)
*Comstock	Insect Life (27)
*Hawks	Science and Art of Poultry Culture (22)

*Suitable for texts.

Author	Title
IV. Agricultural Chemistry and Soils:-	
*King	The Soil (1)
*Vivian	First Principles of Soil Fertility (3)
*Burkett	Soils (3)
Storer	Agriculture in Some of its Relations with Chemistry, 3 vols. (6)
Warrington	Chemistry of the Farm (3)
*Hart & Tottingham	Agricultural Chemistry (7)
Voorhees	Fertilizers (1)
Hall	Fertilizers and Manures (19)
*Snyder	Soils and Fertilizers (1)
King	Irrigation and Drainage (1)
*Henry	Feeds and Feeding (13)
*Jordan	Feeding of Animals (1)
Shaw	Feeding of Farm Animals (3)
*Farrington & Woll	Testing Milk and Its Products (14)
Wing	Milk and Its Products (1)
Gurler	The Farm Dairy (15)
*Lyon & Fippin	Principles of Soil Management (1)
*Russell & Hastings	Experimental Dairy Bacteriology (2)
Conn	Practical Dairy Bacteriology (3)
Lane	The Business of Dairying (3)
*Jones	Notes on Drainage (18)
*Whitson & Walster	Notes on Soils (20)
*Elliott	Practical Farm Drainage (10)
*Snyder	Chemistry of Plant and Animal Life (1)
General Reference Books:-	
Bailey	Principles of Agriculture (1)
Burkett, Stevens & Hill	Agriculture for Beginners (2)
Davis	Rural School Agriculture (3)
Duggar	Agriculture for Southern Schools (1)
Hatch & Hazelwood	Elementary Agriculture (25)
Goff & Mayne	First Principles of Agriculture (4)
Warren	Elements of Agriculture (1)
Massey	Practical Farming (21)

*Suitable for texts.

Author	Title
McLennan	A Manual of Practical Farming (1)
Card	Farm Management (12)
King	The Physics of Agriculture (17)
Terry	Our Farming (3)
Woll	Handbook for Farmers and Dairymen (10)
Hunt	How to Choose a Farm (1)
Bailey	Cyclopedia of American Agriculture (1) 4 vols.
Ogden	Rural Hygiene (1)
Belcher	Clean Milk (3)
Halligan	Fundamentals of Agriculture (8)
Wilkinson	Practical Agriculture (4)
Wilson	Agriculture for Young Folks (9)

General:-

Year-books of the Department of Agriculture.

Farmers' Bulletins, Department of Agriculture.
(Get list from Circular No. 94, U. S. Department of Agriculture).

List of Publishers.

(1) The Macmilan Company, New York.
(2) Ginn & Company, Boston, Mass.
(3) Orange Judd Company, New York.
(4) American Book Company, New York.
(5) W. R. Jenkins Publishing Co., New York.
(6) Charles Scribner's Sons, New York.
(7) E. B. Hart, Experiment Station, Madison, Wis.
(8) D. C. Heath & Co., New York.
(9) Webb Publishing Company, St. Paul, Minn.
(10) John Wiley & Sons, New York.
(11) J. B. Lippincott Company, Philadelphia, Pa.
(12) Doubleday, Page & Company, New York.
(13) W. A. Henry, Experiment Station, Madison, Wis.
(14) Mendota Book Company, Madison, Wis.
(15) Sanders Publishing Company, Chicago, Ill.
(16) E. C. Hastings, Experiment Station, Madison, Wis.
(17) F. H. King, University Ave., Madison, Wis.
(18) E. R. Jones, Experiment Station, Madison, Wis.
(19) E. P. Dutton & Co., New York.

(20) H. L. Walster, Experiment Station, Madison, Wis.
(21) A. C. McClurg & Co., Chicago, Ill.
(22) E. B. Hawks, Clinton, Wis.
(23) G. P. Putnam's Sons, New York.
(24) Charities Publication Committee, 105 E. Twenty-Second St., New York.
(25) Row Peterson & Co., 378 Wabash Ave., Chicago, Ill.
(26) Kenyon Publishing Co., Des Moines, Ia.
(27) D. Appleton Co., Chicago, Ill.
(28) The Torch Press, Cedar Rapids, Ia.
(29) H. W. Mumford, Urbana, Ill.
(30) Manual Arts Publishing Co., Peoria, Ill.

APPENDIX F

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